Amended list of claims for PCT/AU2005/000552 for filing with USPTO.

THE CLAIMS DEFINING THE INVENTION (AS AMENDED) ARE AS FOLLOWS:

1. A biochip for testing biological substances comprising a plurality of binding sites, optical means for determining a specific binding event at each binding site, wherein the plurality of binding sites and the means for determining a specific binding event at each binding site are monolithically integrated into a single chip which is electrically powered and produces electrical signals in response to binding events at each binding site.
2. A biochip in accordance with claim 1 wherein the means for determining a specific binding event comprise at least one light source and at least one photodetector associated with each binding site.
3. A biochip in accordance with claim 2 said biochip further comprising a first plurality of electrodes for individually controlling each light source and a second plurality of electrodes for individually controlling each photodetector.
4. A biochip in accordance with claim 2 wherein either or both the light sources and the photodetectors are implemented in a thin film semiconductor layer.
5. A biochip in accordance with claim 4 wherein the light sources and photodetectors are implemented in the same semiconductor thin film layer.
6. A biochip in accordance with claim 4 wherein the semiconductor thin film material comprises semiconductor polymer.
7. A biochip in accordance with claim 4 wherein the thin film light source is a microcavity light source.
8. A biochip in accordance with claim 4 wherein the thin film photodetector is a microcavity photodetector.
9. A biochip in accordance with any of the preceding claims wherein the means for determining a binding event at each binding site further comprise at least one planar optical waveguide, the evanescent field of light propagating in the waveguide interacting with the biological substance under test.

10. A biochip in accordance with any of the preceding claims wherein the means for determining a binding event at each site comprise means for determining a refractive index change associated with a binding event.

11. A biochip in accordance with claim 10 wherein the means for determining refractive index change comprise a first planar waveguide on surface of which the binding event occurs, a second planar waveguide located below the first waveguide and separated by coupling layer of lower refractive index than that of the two waveguides.

12. A biochip in accordance with claim 10 wherein the means for determining refractive index change comprise a first planar waveguide on surface of which the binding event occurs, a grating formed in said waveguide, a second planar waveguide located below the first waveguide and separated by coupling layer of lower refractive index than that of the two waveguides.

13. A biochip in accordance with any of the preceding claims wherein the means for determining a binding event further comprise a reference light paths provided at each binding site for error correction.

14. A biochip in accordance with any of the preceding claims wherein the biochip comprises a further plurality of electrodes to control hybridization conditions at each binding site.

15. A biochip in accordance with claim 14 wherein the electrodes comprise resistive heater electrodes formed underneath individual binding sites or groups of biding sites.

16. A method of manufacturing a biochip containing light sources, photodetectors, binding sites and optical means for determining a specific binding event at each binding site wherein said light sources, photodetectors, binding sites and optical means for determining a specific binding event at each binding site are produced by processing a single planar substrate in a sequence of deposition, photolithography and etching steps.

17. A method of manufacturing a biochip in accordance with claim 16, said method comprising steps of (i) forming a first plurality of electrodes that are optically

non-transparent; (ii) forming at least one semiconductor layer; (iii) forming a second plurality of electrodes that are optically transparent; (iv) forming at least one planar waveguide layer; (v) forming means of in- and out-coupling for the waveguide layer; and (vi) forming a plurality of binding sites on top on the surface of the waveguide layer.

18. A method of testing a biological substance comprising steps of disposing the substance over a plurality of binding sites, hybridization of the substance to the binding sites and detecting the sites at which the binding events occurred using optical means, said method further comprising the use of a single biochip which is electrically powered and produces electrical signals in response to binding events at each binding site.

19. A method in accordance with claim 18, wherein the biochip allows for in-situ monitoring and detection of binding events at each binding site during the hybridisation.

20. A method in accordance with claim 19 wherein in-situ monitoring and detection comprises generating an optical signal at each binding site and then receiving a corresponding electrical signal from each binding site that contains information about the interaction of the optical signal with the biological substance at each binding site.